Remarks

The above-listed claim amendments along with the following remarks are fully responsive to the Office Action set forth above. Claims 1, 3, 6-8, 10-13, 22, 24, 25, 27, 29, 32-34, and 36-38 are amended. Claims 15-21 and 40-45 were withdrawn from consideration as drawn to a non-elected invention, and are now cancelled. Claims 9 and 35 are also cancelled. New claims 46-60 are added. After entry of this Amendment, claims 1-8, 10-14, 22-34, 36-39, and 46-60 are pending.

No new matter is introduced into the application by the claim amendments or the new claims. The Specification is amended at pages 16-17 and pages 19-20, and claim 24 is likewise amended, to clarify that the infrared dye structure may include an optional bridge Q to complete a 5- or 6-membered carbocyclic ring.

The present invention provides infrared-sensitive compositions, and printing plate precursors comprising a substrate and an infrared-sensitive composition coated on the substrate. The infrared-sensitive composition of the present invention comprises a polymeric binder consisting of a polymer or mixture of polymers having a weight-average molecular weight in the range of 10,000 to 1,000,000 g/mol, with the proviso that the total acid number of said polymeric binder is 70 mg KOH/g or less. The infrared-sensitive composition also comprises a free radical polymerizable system. The free radical polymerizable system consists of a polymerizable component, and an initiator system having a compound capable of absorbing infrared radiation, a compound capable of producing radicals, and a carboxylic acid.

Claim Rejections – 35 U.S.C. § 112

The Examiner rejected claims 1-14 and 22-39 under 35 U.S.C. § 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which Applicants regard as their invention.

The Examiner suggested that the Specification did not set forth a clear definition of what is meant by "total acid number," as used in the claims, with respect to a composition

that comprises a polymeric binder. The Examiner also indicated that the claims did not define what is encompassed by "polymeric binder."

Independent claims 1, 13, 22 and 38 are amended to recite that the infrared-sensitive composition comprises 20% to 80% by weight, based on the composition, of a polymeric binder consisting of a polymer or mixture of polymers having a weight-average molecular weight in the range of 10,000 to 1,000,000 g/mol, with the proviso that the total acid number of the polymeric binder is 70 mg KOH/g or less. Support for the amendment can be found in the Specification at page 13, lines 20-28. While the infrared-sensitive composition may contain other polymers, the term "binder" refers only to a polymer or mixture of polymers having a weight-average molecular weight in the range of 10,000 to 1,000,000 g/mol.

In addition to the polymeric binder, the infrared-sensitive composition includes a polymerizable component selected from unsaturated free-radical polymerizable monomers, oligomers which are free-radical polymerizable and polymers containing C=C bonds in the backbone and/or in the side chain groups. As is now recited in claims 1, 13, 22 and 38, 25% to 75% by weight of the infrared-sensitive composition is the polymerizable component. The polymerizable component would not generally be considered as part of the polymeric binder described above. Where, for example, the polymerizable component is a free-radical polymerizable monomer or oligomer, its molecular weight will normally be significantly lower than 10,000 g/mol and would therefore not be considered in the calculation of total acid number.

It is respectfully submitted that the Specification would be understood by a person of ordinary skill in the art to clearly indicate the manner in which the total acid number is calculated. At page 14, lines 16-19, it is stated that, "All molecular weight characterizations are done by gel permeation chromatography (GPC), and the total acid number is determined by summing the weight percents of the original polymer acid numbers, which were determined by titration." The total acid number is therefore calculated by multiplying the acid number of an individual polymer by its weight percent in the mixture of polymers that makes up the binder, and summing the respective products for each polymer of the binder.

Where only one polymer of the infrared-sensitive composition meets the molecular weight range specified for the binder, then the total acid number will be the acid number of that polymer. For instance, the total acid number for the polymeric binder used in the present Examples 1-3 and 5-16 was zero, and the total acid number for the polymeric binder used in Example 4 was 9.

When the infrared-sensitive composition includes, as the polymeric binder, a mixture of polymers that meet the molecular weight range specified for the binder, the total acid number is calculated with reference to only those polymers that meet the specified molecular weight range, and without consideration of other polymers in the composition. By way of example, the total acid number for a polymeric binder that is a mixture of polymers A and B is calculated as

$$\text{total acid number} = (W_a)(A_a) + (W_b)(A_b),$$

where W_a and W_b are the weight-percents (in decimal format) for polymers A and B, respectively, and A_a and A_b are the acid numbers for polymers A and B, respectively.

In Comparative Example 1, a polymer mixture including 1.62 parts Jagotex MA 2814/MP (terpolymer with an acid number of 125 mg KOH/g and MW about 90K) and 1.62 parts Joncryl 683 (acrylic polymer with an acid number of 150 mg KOH/g and MW about 10K) was used as the polymeric binder. The same mixture was used as the polymeric binder in Comparative Examples 4, 5, and 6. Thus, for Comparative Examples 1, 4, 5, and 6, the total acid number is calculated as (0.50)(125) + (0.50)(150) = 138 (rounded).

At page 40, line 29 it is stated that the total acid number for the binder is 138 mg KOH/g, consistent with the determination exemplified in the previous paragraph. A person skilled in the art would have recognized the method for calculating the total acid number for the polymeric binder. The person skilled in the art would have also recognized that the total acid number given for Comparative Examples 1, 4, 5 and 6 was calculated with reference only to the polymers that make up the binder, and without consideration of any other monomers or polymers in the infrared-sensitive composition. Withdrawal of the rejection is requested.

The Examiner further indicated that the claims included both the term "comprising" and the phrase "consisting of," and that the use of both transitional phrases was inconsistent. The Examiner stated that it was not clear what "consisting of" meant in the claims because it was followed by "comprising" language.

Independent claims 1, 13, 22 and 38 are amended to recite an infrared-sensitive composition comprising an initiator system having a recited quantity of a compound capable of absorbing infrared radiation, a recited quantity of a compound capable of producing radicals, and a recited quantity of a specified carboxylic or a polycarboxylic acid. Support for the amendment can be found in the Specification at page 15, line 7 bridging to page 16, line 2. Support for the recited quantities can be found at page 25, line 29 bridging to page 26, line 2; page 30, lines 1-4; and page 32, line 30 bridging to page 33, line 2.

The Examiner further inquired whether compounds falling between monomer and oligomer are excluded from the free-radical polymerizable system or from the infrared-sensitive composition. The Applicants intend that compounds such as dimers or trimers would be encompassed by the term "oligomer." The Applicants maintain that a person skilled in the art would appreciate that the term "oligomer" may be used to denote a molecule containing more than one repeating unit.

Applicants therefore submit that claims 1-14 and 22-39, as presently amended, are not indefinite. Withdrawal of the rejection is requested.

Claim Rejections – 35 U.S.C. § 102

The Examiner has rejected claims 1-5, 9-14, 22-31 and 35-39 as anticipated by WO 00/48836 of Hauck, *et al.* ("Hauck"). The Examiner states that the composition of Example 1 of Hauck anticipates the presently claimed composition and printing plate precursors.

Applicants submit that claims 1-5, 9-14, 22-31 and 35-39 are not anticipated by Hauck. In Example 1 of Hauck, a mixture of 3.0 grams of an acrylic acid copolymer having an acid number of 180 mg KOH/g and 4.4 grams of a 70 wt.-% solution of a methacrylic acid copolymer having an acid number of 48 mg KOH/g is used as the polymeric binder. The Examiner has improperly focused only on one component of the mixture to provide the

polymeric binder recited in the present claims. As stated above, the term "binder" as used in the claims refers to polymeric components having a weight-average molecular weight in the range of 10,000 to 1,000,000 g/mol. The total acid number for the mixture of polymers must be calculated with reference to all polymers in the composition that meet the specified molecular weight range.

Using the formula given above for calculating the total acid number of the binder, the total acid number for the mixture used in Example 1 of Hauck is 113 mg KOH/g:

$$\frac{3.0}{(3.0+4.4*0.70)}(180)+\frac{4.4*0.70}{3.0+4.4*0.70}(48)=113\,\text{mg KOH/g (rounded);}$$

where the factors of 0.70 are introduced because the methacrylic acid copolymer is added as a 70 wt.-% solution in methyl glycol. The polymeric binder used in Example 1 of Hauck is not within the scope of the present claims, because the total acid number of the polymeric binder is not 70 mg KOH/g or less.

Claims 1-5, 9-14, 22-31 and 35-39 are therefore not anticipated by Hauck. Withdrawal of the rejection is requested.

Claim Rejections – 35 U.S.C. § 103

The Examiner has rejected claims 1-14 and 22-39 as unpatentable over Hauck in view of any of U.S. Patent 5,147,758 to Smothers, *et al.* ("Smothers"), U.S. Patents 5,776,655, 5,888,700, or 5,629,354 to West, *et al.* (collectively "West"), U.S. Patent 6,242,156 to Teng, *et al.* ("Teng"), U.S. Patent 4,228,232 to Rousseau ("Rousseau"), or U.S. Patent 5,756,261 to Takehana, *et al.* ("Takehana").

The Examiner asserts that Hauck teaches all the presently claimed compositions and plates with the exception of using a polymeric binder with an acid number less than 50 mg KOH/g or using a combination of binders wherein the average of the acid numbers is less than 70 mg KOH/g. The Examiner states that Hauck discloses the use of any polymers or polymer mixtures known in the art as the polymeric binder in the reported compositions. The Examiner then alleges that Smothers, West, Teng, Rousseau or Takehana demonstrate that binders having acid numbers in the recited range could be included in the compositions and plates described by Hauck, to yield the presently claimed invention.

The Applicants maintain that the Examiner has not established a *prima facie* case of obviousness. The Examiner has not demonstrated a suggestion or motivation to combine the references. The Examiner has only offered that the references might be combinable. The mere fact that references can be combined does not render the resultant combination obvious unless the prior art also suggests the *desirability* of the combination. See M.P.E.P. § 2143.01.

The proposed combinations do not provide a suggestion or motivation for one skilled in the art to actually combine teachings from the respective references. Although Hauck broadly states that any known binder may be used, Hauck does not provide a motivation to use known binders (or a mixture thereof) having total acid number of 70 mg KOH/g or less. In fact, Hauck distinctly teaches away from using a binder having an acid number in the range recited in the present claims. "In view of possible problems occurring in connection with ink acceptance during the printing process, it is preferred that the used polymer has an acid number of > 70 mg KOH/g, or, when polymer mixtures are used, that the arithmetic average of the individual acid numbers be > 70 mg KOH/g." See Hauck, p. 6 at first full paragraph. Hauck continues by expressing that a preferred acid number value is greater than 110 mg KOH/g, and that an acid number in the range 140-160 mg KOH/g is especially preferred. Hauck therefore suggests maintaining an acid number significantly higher than the presently claimed range, and the preferences stated by Hauck indicate that moving to a higher acid number is advantageous.

A person skilled in the art would look to the statement of Hauck as an indication that using a binder having an acid number of 70 mg KOH/g or lower would result in a printing plate that is not suited for its purpose, as Hauck has identified ink-acceptance problems when using such a binder. Based on the statement from Hauck, a person skilled in the art would have no reasonable expectation of successfully obtaining a useable printing plate by employing a binder having total acid number of 70 mg KOH/g or less.

A person skilled in the art would also understand that, by using a binder having a lower acid number than suggested by Hauck, or especially an acid number of zero, the resulting printing plate precursor would likely be more difficult to process in known aqueous

alkaline developers. The skilled person would thus have little or no expectation of success in obtaining a printing plate precursor that can be processed in an aqueous developer.

In spite of the teaching of Hauck, the Applicants have discovered that, by employing a binder having a total acid number of 70 mg KOH/g or less in a printing plate precursor, a suitable printing plate may be made. The printing plate precursor may be imaged using infrared radiation, and subsequently processed using a suitable aqueous developer, as demonstrated in the present Examples. Furthermore, by employing a binder having a total acid number of 70 mg KOH/g or less, several advantages may be realized.

First, the printing plate precursors of the present invention do not require what is known in the art as a "post-exposure bake," in contrast to the printing plates described by Hauck. As stated in Hauck at page 19, fourth paragraph, "After the printing plate precursor has been imagewise exposed, it is briefly heated to a temperature of 85 to 135°C in order to effect complete curing of the exposed areas. Depending on the temperature applied, this only takes 20 to 100 seconds." In the examples of Hauck, a post-exposure bake was generally done at 90° C for one minute, prior to development. See page 22, second full paragraph; see also page 23, first full paragraph.

Neither Hauck nor any other cited reference teaches or suggest that a post-exposure bake can be eliminated by using a binder having an acid number of 70 mg KOH/g or less. In contrast, as discussed at page 12, lines 10-18 of the present Specification, no post-exposure bake is required prior to developing the printing plate precursors of the present invention. Elimination of a post-exposure baking step leads to increased throughput in imaging and developing plates, and provides better reproducibility in establishing proper exposure energies and in image quality.

As demonstrated in the present Examples 1 through 4, coating formulations including a binder having an acid number in the range of about 0-9 mg KOH/g were used to make a printing plate precursor; for these precursors, no post-exposure bake was required and excellent sensitivity (26-40 mJ/cm^2) was observed. In contrast, in Comparative Examples 1 through 3, a binder having a total acid number in the range of about 125-150 mg KOH/g was

used to make a printing plate precursor; for these precursors, no coating was retained on the substrate when no post-exposure bake was done.

Second, the printing plate precursors of the present invention exhibit better sensitivity than those including a binder having a total acid number greater than 70 mg KOH/g. In the present Example 1, a coating formulation including a binder having an acid number of 0 was used to make a printing plate precursor. The minimum exposure energy necessary to achieve maximum processed density (i.e., the "sensitivity") of the precursor was measured as about 26 mJ/cm^2. By substituting a binder having a total acid number of about 138 mg KOH/g as in Comparative Example 1, the sensitivity of the precursor was measured as about 50 mJ/cm^2. This result is not suggested by Hauck, nor by any reference cited by the Examiner.

In sum, none of the prior art references suggests the desirability of making the combination proposed by the Examiner. None of the references suggests that post-exposure baking can be eliminated, or that greater sensitivity can be attained, by using a binder having a total acid number of 70 mg KOH/g or less. Nor do they suggest any other desirable reason for combining the teachings of the references of the combination proposed by the Examiner. In fact, the teaching of Hauck would lead a person skilled in the art *away* from using a binder having a total acid number of 70 mg KOH/g or less. Therefore, the proposed combinations fail to establish a *prima facie* case of obviousness. Withdrawal of the rejection is requested.

The Examiner indicated in the Office Action that the Applicants have not made a showing relative to the nearest prior art compositions (i.e., the compositions of Hauck or the plates of Teng). The Examiner further stated that there is no showing in the instant Specification for a binder having an acid number above 9 mg KOH/g. In order to be fully responsive to the outstanding Office Action, Applicants submit that the requested data is needed only if the Examiner has made out a *prima facie* case of obviousness, for the purpose of rebutting the *prima facie* case and establishing unobviousness. Since no *prima facie* case has been established, no supplementary data is needed.

The Examiner also rejected claims 1-14 as unpatentable over EP 0 889 363 A1 of Weed, *et al.* ("Weed"). The Examiner states that Weed teaches the use of an infrared-absorbing dye, a halogenated hexaarylbiimidazole ("HABI") compound that can generate

free radicals, and n-phenylglycine to polymerize compositions with ethylenically unsaturated compounds and binders inclusive of binders without acid groups. The Examiner concedes that no working example is shown using those components, but contends that each variation is taught and that the compositions are taught to be used in flexographic printing plates.

Weed reports a photopolymerizable composition comprising a near-infrared dye photochemical sensitizer, a HABI photoinitiator, a chain transfer agent, and a photopolymerizable material such as an ethylenically unsaturated monomer; see Abstract. Weed reports at page 6 that the compositions preferably contain one or more binder polymers as an optional component. The binder polymer is not required to, but preferably does, contain acid functionality for aqueous processability; see page 6 at lines 10-11. Where acid-functional binders are used, a suitable binder is reported to have an acid number in the range 90-160; see page 6 at lines 13-15.

Weed states that acid functionality for the binder is not required where development is effected using solvent development with an organic liquid developer or semiaqueous development with a liquid mixture containing water and an organic solvent; see page 6 at line 57, bridging to page 7 at line 2. One example from Weed, Example 31 (pages 18-19), demonstrates a flexographic printing plate precursor photopolymerizable composition comprising a binder having no acid functionality. However, the imaged precursor requires development in tetrachloroethylene (TCE) or a mixture of a solvent such as TCE with suitable alcohols; see p. 19 at line 21-22. The binder includes a styrene-butadiene-styrene block copolymer and a styrene-butadiene block copolymer.

The present claim 1 is directed to an infrared-sensitive composition comprising a recited binder having a total acid number of 70 mg KOH/g or less and a recited free radical polymerizable system. Claim 1 has been amended to recite that the composition, in an uncured form, is dispersible in a suitable aqueous developer. As demonstrated by the present examples, the inventive composition is dispersible in an aqueous developer when uncured. In particular, one suitable aqueous developer comprising about 83.58 wt.-% water (with the balance being largely due to anionic surfactants and (poly)vinyl alcohol dispersant) can be prepared according to the formulation given in Table 2 at page 37.

Weed neither teaches nor suggests the presently claimed infrared-sensitive composition. In particular, Weed does not provide an infrared-sensitive composition that comprises a binder having a total acid number of 70 mg KOH/g or less, and that is dispersible in an aqueous developer. Weed teaches that a binder should have acid functionality where aqueous processability is desired, and suggests an acid number in the range 90-160. In Example 31 of Weed, where a lower acid number is used, the plate is processed in an organic solvent. The binder, comprising a styrene-butadiene-styrene block copolymer and a styrene-butadiene block copolymer, would not be expected to be dispersible in an aqueous developer. Therefore, Weed does not provide a reasonable expectation of obtaining an infrared-sensitive composition that comprises a binder having a total acid number of 70 mg KOH/g or less, and that is dispersible in an aqueous developer. Claims 2-12 depend from claim 1 and recite additional features, and are patentable for at least the same reason. Withdrawal of the rejection is requested.

The present claim 13 is directed to a printing plate precursor comprising a substrate and a recited infrared-sensitive composition coated on the substrate. The infrared-sensitive composition comprises a recited binder having a total acid number of 70 mg KOH/g or less. Claim 13 has been amended to recite that the precursor is imageable by exposure to infrared radiation, and subsequently processable with a suitable aqueous developer to yield a printing plate. Claim 14 depends from claim 13 and recites that the precursor further comprises an oxygen-impermeable overcoat.

Weed neither teaches nor suggests the presently claimed printing plate precursor. In particular, Weed does not provide a precursor comprising a coating that includes a binder having a total acid number of 70 mg KOH/g or less, and that is imageable by exposure to infrared radiation and subsequently processable with a suitable aqueous developer to yield a printing plate. Weed teaches that a binder should have acid functionality where aqueous processability is desired, and suggests an acid number in the range 90-160. In Example 31 of Weed, where a lower acid number is used, the plate is processed in an organic solvent. Therefore, Weed does not provide a reasonable expectation of obtaining an infrared-imageable precursor that comprises a binder having a total acid number of 70 mg KOH/g or

less, and that is processable with a suitable aqueous developer to yield a printing plate. Withdrawal of the rejection is requested.

Conclusion

All pending claims are now in condition for allowance. A notice to that effect is solicited.

Respectfully Submitted,

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